

^{59}Co NMR Study of $(\text{U,Nd})\text{Co}_2\text{Ge}_2$ and LaCo_2Ge_2

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Compounds of the $(\text{U,Ln})\text{Co}_2\text{Ge}_2$ system $\{\text{Ln}=\text{lanthanide}\}$ crystallize in the BCT ThCr_2Si_2 -type structure, and order magnetically in a variety of structures, in which only the (U,Ln) atoms (f-electrons) carry localized moments. The magnetic interactions can be described using the indirect exchange RKKY model, where the U atoms behave magnetically like a light Ln in this system. We have performed ^{59}Co NMR measurements on the $(\text{U}_{1-x}\text{Nd}_x)\text{Co}_2\text{Ge}_2$ ($x=0,0.25,0.5,0.75,1$) and LaCo_2Ge_2 . RT NMR spectra consist of 7 lines, attributed to the quadrupole splitting due to the ^{59}Co nuclear spin $I=7/2$, with $\Delta q \sim 1\text{MHz}$. For UCo_2Ge_2 a second set of 7 lines is seen with $\Delta q \sim 0.5\text{MHz}$, probably due to a mixed valence state of the Co atoms. In the paramagnetic region, the resonance frequencies of the NMR lines of the $(\text{U,Nd})\text{Co}_2\text{Ge}_2$ compounds increase linearly with $1/T$ and with the magnetic susceptibility, consistent with the indirect exchange interaction expected in these compounds. For LaCo_2Ge_2 , being non-magnetic, no such shift is observed. The conduction-f electrons exchange coefficient, J_{cf} , of UCo_2Ge_2 and NdCo_2Ge_2 is estimated as $-0.06(3)\text{eV}$ and $-0.16(9)\text{eV}$, respectively. A negative J_{cf} is in agreement with a Kondo effect appearance in these materials, as was discussed previously. The NMR lines are smeared below the magnetic transition temperatures of the studied compounds, except for UCo_2Ge_2 where a spectrum with $\Delta q \sim 0.5\text{MHz}$ is observed.

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